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BATTLEFIELD AUTOMATION

Better Justification and Testing Needed for Common Computer Acquisition

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The Honorable Ted Stevens
Chairman, Subcommittee on Defense
Committee on Appropriations
United States Senate

The Honorable Bill Chappell, Jr.
Chairman, Subcommittee on Defense
Committee on Appropriations
House of Representatives

In response to your requests and subsequent discussions with your offices, we evaluated whether the Army Command and Control System Common Hardware and Software acquisition program was a sound and economical approach for providing battlefield computer systems.

As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution of this report until 30 days from its issue date. At that time, we will send copies of the report to the Secretary of Defense, the Secretary of the Army, the Chairmen of the House and Senate Committees on Armed Services, and make copies available to other interested parties and upon request.

Dan White
for Ralph V. Carlone
Director

Executive Summary

Purpose

Since 1976, the Army has initiated several programs addressing battlefield automation and communication problems and unfulfilled needs. The Army Command and Control System program is the Army's comprehensive approach to command and control systems. An important objective of this program is the acquisition of compatible, off-the-shelf computer hardware and software for four battlefield systems: fire support, maneuver control, air defense, and combat service support.

The Chairmen of the House and Senate Appropriations Subcommittees on Defense asked GAO to assess whether this planned acquisition (1) provides a sound, economical approach for acquiring computer systems, and (2) meets the needs and schedules of the battlefield system programs.

Background

The Army issued the Army Command and Control Systems Common Hardware and Software request for proposal in May 1987, and plans to award a production contract to a prime contractor in April 1988. At the time of contract award, the Army plans to buy at least 4,259 systems of various types at a cost of about $200 million. If Army exercised all contract options, it would acquire 114,000 more systems at an estimated total cost of $3.4 billion. However, the Army has currently identified requirements for a total of 25,607 systems costing an estimated $909 million.

Results in Brief

The Army has not established that its approach for acquiring common hardware and software for battlefield systems is sound and economical. The Army (1) has not performed a cost and operational effectiveness analysis to determine the best approach for meeting mission needs and (2) plans to buy production quantities before fully testing them. Two Army studies have questioned the economy, risk, and effectiveness of the common acquisition. One of them concluded that the acquisition strategy had a high degree of risk.

It is uncertain whether the Army's acquisition strategy will provide common hardware and software that will meet the individual battlefield systems requirements, since pre-award testing will not determine if proposed products satisfy all request for proposal specifications or battlefield system requirements. Also, the Army's acquisition is not consistent and coordinated with the current battlefield system development efforts. For example, the Army plans to buy production quantities of the

common hardware and software before operationally testing it with the battlefield systems and before these battlefield systems have been developed.

Principal Findings

Economy of Consolidated Acquisition Is Questionable

The Army's common acquisition strategy assumes that off-the-shelf computer systems with the required capabilities are readily available and that a consolidated acquisition—rather than separate, tailored acquisitions for the individual battlefield systems—is more economical. However, Army market surveys and GAO discussions with six vendors indicate that off-the-shelf products do not meet all of the important Army requirements. Army officials have stated that the economies of the common acquisition program are obvious. In our opinion, however, the economy of a common acquisition for all battlefield systems is questionable, because (1) an Army study has indicated that the economies of scale will not be achieved with the current staggered schedule for battlefield system deployment and (2) another Army study has shown that a separate, tailored acquisition for one of the battlefield systems would cost an estimated $66.9 million (or 33 percent) less than comparable equipment purchased through the common program.

Army Has Not Justified Acquisition Strategy

The Army has not made a full cost and operational effectiveness analysis for this acquisition as required by Army regulations for major system acquisitions. A full analysis should evaluate the costs, effectiveness, and risks of (1) use of off-the-shelf products versus new production development and (2) a separate acquisition for each battlefield system rather than a common acquisition. The Army has stated that performing this analysis would delay the acquisition and that the full analysis is not required because it believes that the Army regulation only applies to major systems acquisitions and this is not a system acquisition. The Under Secretary of Defense for Acquisition has designated this a major acquisition and that its applicable major system acquisition guidance will be applied to it. The need for a full analysis of this acquisition is further underscored by an independent Army assessment that concluded that the acquisition strategy had a high degree of risk. We believe a full cost and operational effectiveness analysis should be performed for major acquisitions and that the potential size and risks of

this common hardware and software acquisition warrant such an analysis.

Systems Will Not Be Fully Tested Until After Production Contract Award

The applicable Defense Directives and Army Regulations for major systems acquisitions require that a complete prototype system, including software, be successfully tested in a military environment before making a production commitment. However, for this planned acquisition, important testing may not be performed until after the production contract is awarded. The Army request for proposal allows vendors to propose new or modified products that are unproven, and to delay demonstrating important product capabilities, such as critical communications interfaces, until up to 10 months after contract award. Further, operational testing and evaluation is not planned until after substantial production quantity commitments are made. If the Army initially only acquires the quantities of common hardware and software needed for battlefield system development and testing, and does not commit to deployment quantities, the Army will need less than the 4,259 computer systems now planned as an initial commitment. The Army officials believe the demonstration of capabilities after the award is an acceptable risk.

Delays in Battlefield System Developments

The development of the fire support system, the first of the four battlefield systems intended to use the new common hardware and software systems, has fallen 2 years behind schedule (i.e., the earliest it will be ready for deployment is 1992). The other three battlefield systems that are to use the common hardware and software are not scheduled for completion or deployment with common hardware and software until at least 1992. This gives the Army more time to analyze its acquisition strategy and test the equipment before it is needed for deployment of any of the four battlefield systems. (See GAO/NSIAD-88-42FS, December 9, 1987.)

Recommendations

GAO recommends that the Secretary of the Army:

- Complete a full cost and operational effectiveness analysis demonstrating the best strategy for meeting battlefield system requirements before awarding a common hardware and software contract;
- If the cost and operational effectiveness analysis shows that the common acquisition approach is the best strategy, conduct pre-award testing

that determines the ability of each vendor's common hardware and software to meet critical processing and communication requirements of the four battlefield systems; and

- If, as a result of successful pre-award testing the Army proceeds with the acquisition, initially procure only those quantities needed for development and testing and defer production quantity commitments for deployment until operational testing shows that the common hardware and software enables the battlefield systems to meet their required operational capabilities.

Agency Comments

As requested by the House Appropriations Subcommittee on Defense, and with the agreement of the Senate Subcommittee, GAO did not obtain official agency comments on a draft of this report. However, during the course of its work, GAO discussed the facts in this report with agency program officials and has incorporated their comments where appropriate. This work was performed in accordance with generally accepted government auditing standards.

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Abbreviations

ACCS	Army Command and Control System
CHS	common hardware and software
GAO	General Accounting Office
IMTEC	Information Management and Technology Division

Chapter 1

Introduction

The Chairmen of the House and Senate Appropriations Subcommittees on Defense requested us to address whether the planned Army Command and Control System (ACCS) common hardware and software (CHS) acquisition (1) provides a sound, economical approach for acquiring computer hardware and software for battlefield systems, and (2) meets the requirements and schedule of the battlefield system programs designated to use CHS.

Since 1976, the Army has initiated several programs addressing problems and unfulfilled needs in its battlefield automation and communications. Its comprehensive approach to command and control systems is called the ACCS program. An important objective of this program is the deployment of modern computer systems in battlefield environments through a consolidated acquisition of compatible, off-the-shelf[1] CHS products that require minor or no development to meet requirements. In 1985, Army established the CHS program to achieve this objective.

In developing its command and control system plan, the Army identified five battlefield functional areas that it believed could be aided by automated systems. These functional areas are: (1) planning, direction, and control of artillery (fire support); (2) status monitoring of troop movements and general battlefield conditions (maneuver control); (3) control of short-range air defense weapons (air defense); (4) management of supply, maintenance, transportation, medical, and personnel activities (combat service support); and (5) reception, analysis and distribution of intelligence information (inteiligence and electronic warfare).[2]

The Army intends to develop a network of battlefield systems within and among battlefield functional areas to provide the commanders with the information needed to manage forces on the battlefield. Within each battlefield functional area the network consists of a single automated control system and related subordinate systems—some manual and others automated. To ensure that needed information is available at key locations in this network, the Army's command and control system plan calls for battlefield systems to exchange data through the use of standard Army tactical communication systems.

[1]Off-the-shelf products (referred to by the Army as nondevelopmental items) are either existing, proven Army-developed products or commercially proven and available products.

[2]In 1986, the Army exempted the intelligence and electronic warfare control system—All Source Analysis System—from the CHS acquisition because of its security requirements and advanced stage of development using nonstandard programming languages.

Responsibility for developing automated control systems for the five battlefield functional areas rests with four Army commands. These commands are: (1) the Missile Command for air defense; (2) the Communications - Electronics Command for maneuver control and fire support; (3) the Information Systems Command for combat service support and its subordinate unit-level computer system; and (4) the Deputy Chief of Staff for Operations and Plans for intelligence and electronic warfare.

In May 1987, the ACCS program manager position, which previously existed within the Army Materiel Command, was replaced by the program executive officer for command and control systems. This change resulted from Army's implementation of the Packard Commission[3] recommendations. The program executive officer reports directly to the Army acquisition executive, who is the Under Secretary of the Army. Also, in June 1987, the Army designated a program manager for the CHS program who is responsible for developing, acquiring, testing, and supporting new and improved common hardware and software to be used by the battlefield systems. He reports to the program executive officer for command and control systems.

The automated system development efforts for control systems are at different stages of completion. The initial version of the maneuver control system is being deployed. The air defense, fire support, and intelligence and electronic warfare control systems are defined and system development is underway. The Army has not yet defined its requirements for the combat service support control system.

The CHS acquisition is intended to support ACCS battlefield systems. The CHS acquisition strategy is to maximize the use of off-the-shelf commercial computer hardware and software products, and acquire ruggedized—rather than militarized—versions of computer hardware for the more stringent operating conditions.[4] The program managers for battlefield system initiatives are to use the CHS contract to acquire the computer systems they need for system development, testing, and deployment. The program executive officer for command and control systems and the CHS program manager are to manage the acquisition, testing, and deployment of CHS for these systems.

[3]The President's Blue Ribbon Commission on Defense Management (Packard Commission) report, "A Quest for Excellence," July 1986.

[4]Ruggedized hardware has been adapted to enhance its capabilities in a stressful environment, but is often less tolerant of adverse operating conditions than militarized hardware. Militarized hardware has been specifically designed and custom built for military use to operate under adverse conditions.

CHS Program Description

The Army issued the CHS request for proposal on May 1, 1987 and anticipates awarding a production contract in April 1988. The Army plans to award a firm, fixed-price contract to a prime contractor for 5 years with a number of options. The computer hardware to be acquired includes hand-held, portable, and transportable units, as well as peripheral devices to be used with the portable and transportable units. The hand-held unit is expected to weigh less than 8 pounds and will be used by personnel in forward battlefield areas as a data entry device. It is intended to be ruggedized to withstand military use in a stressed environment.

The portable and transportable units, and the peripheral devices, such as disk drives and printers, are to be provided in two versions—a commercial off-the-shelf product and ruggedized version. The software to be acquired includes operating systems, data base management systems, programming tools for the Ada computer language[1], as well as programs for communication, training, and problem diagnosis.

The portable unit will be used as a stand-alone system and/or as a network workstation. It is anticipated to have processing and storage capabilities similar to commercial personal computers. The transportable unit will be larger than the portable unit and will have greater processing and storage capacity. The transportable unit is supposed to be small enough to be carried by two people.

Program Estimates

The Army anticipates committing, at the time the contract is awarded, to acquire a 5-year base quantity of CHS. The 5-year base quantity in the request for proposal is 4,259 computer systems that would cost about $200 million. The Army has not estimated how many of these computer systems would be required to support the software development and operational testing of the battlefield systems. However, the required quantities would be less than the 4,259 base quantity of CHS.

In addition to the base quantity, the CHS request for proposal requires that offerors establish prices for optional CHS quantities. The exercise of all options would provide an additional 114,000 computer systems. Based on Army estimates, the total value of the contract would be $3.4 billion if all options were exercised. However, as shown in table 1.1, the Army, as of August 1987, had identified requirements for only

[1]Ada is the official Department of Defense standard programming language for developing mission-critical computer software.

25,607 computer systems. Table 1.2 shows that these systems are estimated to cost $909.2 million.

Table 1.1: Army's Estimated CHS Requirements

	Mission areas				
CHS Systems	**Air defense**	**Fire support**	**Maneuver control**	**Combat service support**	**Total systems**
Hand-held unit	2,122	3,767	•	•	5,889
Portable (commercial)	1	36	464	14,094[a]	14,595
Portable (ruggedized)	90	2,920	620	•	3,630
Transportable (commercial)	2	30	245	•	277
Transportable (ruggedized)	182	624	410	•	1,216
Total	**2,397**	**7,377**	**1,739**	**14,094**	**25,607**

[a]Includes 1,191 systems for the control system and 12,903 systems for the unit-level computer subordinate system.

Table 1.2: Estimated Cost of Planned CHS Acquisitions for Battlefield Systems (in millions and unless otherwise noted, funds are from "Other Procurement" accounts)

	Fiscal year						
System	**1988**	**1989**	**1990**	**1991**	**1992**	**Out years**	**Total**
Air defense	$9.3	$11.4	$11.8	$20.8	$19.3	•	$72.6[b]
Fire support	63.2	47.6	35.0	44.1	32.9	$253.0	475.8[c]
Maneuver control	•	•	31.1	•	8.3	112.2	151.6[d]
Combat service support	•	•	•	•	•	30.8	30.8
Unit-level computer[a]	71.9	59.7	46.8	•	•	•	178.4[e]
Total	**$144.4**	**$118.7**	**$124.7**	**$64.9**	**$60.5**	**$396.0**	**$909.2**

[a]In March 1987, the Under Secretary of the Army directed that unit-level computer acquisitions be included in the CHS acquisition. The Army plans to acquire the commercial version of the CHS portable computer system to meet unit-level computer system requirements.

[b]Includes $3.6 million (fiscal year 1988) for research, development, testing, and evaluation.

[c]Includes $6.6 million (fiscal year 1988) for research, development, testing, and evaluation.

[d]Based on Army estimates, the maneuver control system program has a requirement for 1,163 battalion devices, costing an estimated $68 million. This is not included in the Army's current CHS acquisition cost and quantity estimates.

[e]All but $10.3 million of the amount will be funded from the operations and maintenance accounts.

Past GAO Reports

We have issued four reports addressing areas directly related to the ACCS CHS initiative.[6] In May 1986, we reported on the Army's plan for acquiring and distributing computer hardware for the maneuver control system (one of the battlefield systems designated to use CHS) suggesting areas of potential savings when deploying systems to active forces. In August 1986, we reported on the status of the battlefield system programs that will use CHS and reported the lack of a charter for the ACCS program manager.

In September 1986, we questioned the cost-effectiveness of the interim maneuver control system off-the-shelf computer acquisition because the Army had not shown it to be more cost effective than the proposed CHS acquisition. Our report recommended that, before proceeding with the maneuver control system computer acquisition, the Army demonstrate to the Congress that this interim computer hardware and software acquisition was cost-effective and consistent with the ACCS CHS program. A March 1987 Army report[7] to the House Appropriations Subcommittee on Defense showed, among other things, that a separate acquisition for this battlefield system is less costly than meeting this requirement through the CHS acquisition. Our December 1987 report on the status of ACCS battlefield systems programs reported additional cost growth and schedule delays for all five ACCS control system acquisition programs.

Objectives, Scope, and Methodology

As requested by the Chairmen of the House and Senate Appropriations Subcommittees on Defense, the objectives of our review were to determine whether the ACCS CHS program provides a sound and economical approach for acquiring computer hardware and software that meets the requirements of the battlefield systems, and is consistent and well-coordinated with current battlefield system development programs.

To accomplish these objectives we reviewed program, acquisition, and technical documents, and acquisition regulations, and interviewed key Department of Defense officials at the:

[6] Tactical Computers: Army's Maneuver Control System Procurement and Distribution Plan (GAO/IMTEC-86-21FS, May 23, 1986); Battlefield Automation: Status of the Army Command and Control System Program (GAO/NSIAD-86-184FS, August 26, 1986); Tactical Computers: Army's Maneuver Control System Acquisition Plan is Not Cost-Effective (GAO/IMTEC-86-26BR, September 3, 1986); and Battlefield Automation: Status of Army Command and Control Systems Acquisition Cost and Schedule Changes (GAO/NSIAD-88-42FS, December 9, 1987). Other ACCS-related reports are listed in appendix I.

[7] The Maneuver Control System: A Whitepaper Responding to Congressional Questions, March 23, 1987.

- Office of the Secretary of Defense;
- ACCS program and procurement offices at Fort Monmouth, New Jersey;
- ACCS battlefield system program offices at Fort Monmouth, New Jersey; Huntsville, Alabama; and McLean, Virginia; and
- Army Training and Doctrine Command at Fort Leavenworth, Kansas.

We reviewed the CHS draft, revisions, and final (May 1987) request for proposal, and subsequent amendments. We also reviewed the responses from vendors concerning the draft released in December 1986 for industry comment. Meetings were held with six of the 28 vendors that responded to the draft to discuss the potential of their products and the general capabilities of the computer industry to meet ACCS CHS requirements.

We selected the vendors based on either the ACCS program manager identifying them as likely to bid on the CHS contract or on their providing comments on the draft request for proposal that demonstrated they had knowledge of whether industry could provide products to meet CHS requirements.

After our audit work was complete, we received correspondence from an additional vendor who asserted that off-the-shelf commercial products would be available to meet CHS requirements. Because of a lack of documentation supporting this assertion and the proprietary nature of vendors' proposals, we could not evaluate these assertions. Army's proposal evaluation and product tests before contract award, are aimed at determining whether available commercial products meet CHS requirements (see chs. 3 and 5).

Finally, because of the differences in the judgments of Army officials as to the degree of risk involved in the CHS acquisition, we employed an independent consultant, who is an established authority on Army tactical communications systems, to review the CHS procurement documents, particularly the technical specifications and testing requirements, and provide us an independent assessment of the technical risks.

Our review was conducted from September 1986 through August 1987. We discussed our findings with program officials and included their comments where appropriate. However, in accordance with requester wishes, we did not obtain official agency comments on a draft of this report. We performed our work in accordance with generally accepted government auditing standards.

Army Did Not Justify CHS Strategy

The Army has not adequately justified its CHS acquisition strategy. The cost and operational effectiveness analysis required by Army regulations has not been performed to determine the best approach for meeting mission needs. Rather, the Army CHS acquisition strategy is based on assumptions that off-the-shelf products with the required capabilities would be readily available, and that a consolidated acquisition would be more economical. However, it is unclear that off-the-shelf products that meet all CHS requirements are currently available, and one Army study raises serious questions about the economy of a consolidated acquisition. Further, an independent Army assessment of the CHS acquisition concluded that the acquisition strategy had high risk. Our independent consultant's assessment indicates that communication software required for Army tactical communication systems is a particular area of high technical risk.

Army Regulation 71-9 requires a full cost and operational effectiveness analysis be performed for a major system acquisition, before the Army awards a contract, to ensure that it has chosen the right approach for meeting mission needs. The Army, however, told us it does not plan to perform a full cost and operational effectiveness analysis for the CHS acquisition because they do not think a full analysis is required by Army regulations, and they do not want to delay the acquisition schedule. By January 1988, the Army plans to complete an abbreviated cost-benefit analysis for the CHS acquisition. The Army's cost-benefit study, now underway, does not fully explore a variety of technical and acquisition alternatives, or explore the technical risks of each alternative to obtain the best technical approach.

Cost and Operational Effectiveness Analysis Has Not Been Performed

Army Regulation 71-9 requires that a cost and operational effectiveness analysis be made before starting a major system acquisition. This analysis is intended to determine the best approach for meeting mission needs by evaluating and comparing the cost, operational effectiveness, and technical risk of alternatives.

The Army went forward with the CHS initiative without performing this analysis because, as indicated in Army briefings and an Army market survey, it assumed that off-the-shelf computer hardware and software products with needed capabilities were readily available and a combined acquisition would be more economical because of volume purchases and simplified logistics. While this is an intuitively appealing assumption, it has not been demonstrated by Army studies that these economies of

purchase and logistics can be realized and that the needs of the various battlefield system programs will be satisfied by this CHS procurement.

ACCS program officials told us they do not plan to perform the full cost and operational effectiveness analysis because they believe the regulation applies only to systems and that the CHS acquisition is not a system acquisition. The Army is performing an abbreviated cost-benefit analysis of the CHS acquisition, which is to be completed in January 1988. However, according to Army officials, this analysis will not compare all available technical and acquisition alternatives, such as different processor architectures and separate acquisitions for each battlefield system program, and will not explore the technical risks of these alternatives.

The CHS acquisition meets Department of Defense criteria for a major acquisition program because it could result in the expenditure of approximately $3.4 billion. The Under Secretary of Defense for Acquisition has designated the CHS acquisition as a major acquisition program and indicated it should be reviewed by the Defense Acquisition Board and otherwise follow major information system acquisition guidance. We believe a full cost and operational effectiveness analysis should be performed for major acquisition programs to ensure that the best alternative has been selected. In our opinion, because of the potential size and risks of this acquisition, whether or not it is considered a system acquisition, a full cost and operational effectiveness analysis is needed before a contract is awarded. Further, as discussed in chapter 4, development of the battlefield systems that will use CHS has been delayed, allowing additional time to perform a full cost and operational effectiveness analysis for the CHS acquisition.

Army Assumed Needs Could Be Met With Readily Available, Off-The-Shelf Products

The ACCS CHS acquisition strategy, approved in December 1986, emphasized that off-the-shelf commercial hardware and software products that are in production would be procured. However, the deputy ACCS program manager told us that their market surveys did not identify a commercially-available product line, or a collection of compatible commercial products from different product lines that meet all CHS requirements. Further, he told us that at the time the CHS request for proposal was issued, he knew of no offeror able to meet all requirements.

Our discussions with six selected prospective offerors have indicated that off-the-shelf products that meet CHS requirements for processing capabilities, including operating system features needed for time-critical

applications, and operation in a stressed environment, including tracked vehicle vibration and high-altitude nuclear blast emission effects, are not yet available. Prospective offerors also said that it will be difficult to develop communication software that the CHS systems need in order to send information through Army tactical communication systems. A seventh vendor, however, recently asserted that his proposal would incorporate off-the-shelf hardware and software that would fully meet the Army's requirements. Because his correspondence did not include sufficient technical documentation and his proposal contains substantial proprietary data, we could not evaluate the validity of his assertions, without substantially inserting ourselves into the procurement process while it is underway. However, Army's proposal evaluations and product demonstrations for this acquisition, currently underway, are supposed to provide an examination of their validity.

The CHS request for proposal recognizes that off-the-shelf products may not yet be available and permits the successful offeror to demonstrate several of the required capabilities after contract award. Offerors must provide pre-production models for pre-award testing; however, these models are not required to meet all CHS requirements. If offerors do not meet all CHS requirements, their proposals must then explain how they will modify their proposed products to meet the CHS requirements. The successful offeror is not required to demonstrate that his products meet all required environmental capabilities until 9 months after contract award. The successful offeror also has up to 10 months after contract award to demonstrate all required communication capabilities. Further, the Army may defer the successful offeror's demonstration of other required capabilities until after contract award.

The deputy ACCS program manager said that demonstrating some communication, processing, and environmental requirements after awarding a production contract is an acceptable risk because industry has demonstrated the ability to provide required CHS features on past products, particularly the features required for computers to operate in a stressed environment. Furthermore, the successful offeror need only integrate available technologies. The deputy program executive officer for command and control systems told us that while some communication capabilities would be more difficult to develop than others, he was confident the successful offeror would be able to provide all required communication capabilities when needed.

We believe, however, that the acquisition strategy being followed by the Army may not be the best approach. The Army is now in the position of

awarding a contract for partially or totally unproven products when it intended to acquire proven, off-the-shelf products. Since product development will be needed to meet the Army's requirements, a formal analysis of acquisition approaches considering cost, operational effectiveness, and technical risk would show whether an off-the-shelf CHS acquisition strategy or a major system development acquisition strategy should be followed. This analysis is needed before a contract for CHS is awarded in order to avoid unnecessary acquisition costs, reduce technical risk, and to help ensure that mission needs are met in a timely and cost-effective manner.

Economies of Combined Acquisition Questioned by Army Analyses

Army briefings to various Department of Defense officials have cited potential savings in the CHS acquisition strategy. However, the ACCS program office has not documented these claims. Two Army studies lead us to question whether the economies of scale and the procurement cost savings will be obtained.

The volume of purchase commitments for the consolidated acquisition may not be large enough to offer economic advantages over separate acquisitions, because of the staggered schedule for deployment of these systems. In May 1986, the Army Materiel Systems Analysis Activity[1] assessed the CHS initiative and questioned the Army's ability to achieve economies of scale with this approach. The assessment concluded that the attainment of economies of scale required the simultaneous deployment of battlefield control systems. CHS acquisition documentation assumed that four battlefield control systems would be ready to deploy in 1989. However, based on current schedules for these systems, simultaneous deployment will not occur.

One economic analysis regarding the consolidated acquisition versus separate acquisitions tailored to individual battlefield system requirements, projected lower costs for the separate acquisitions approach. A March 1987 Army report to the House Appropriations Subcommittee on Defense concerning a planned computer system acquisition for one of the battlefield systems—the maneuver control system—showed that a separate acquisition was less costly than the consolidated CHS acquisition approach. The report concluded that a separate tailored acquisition of maneuver control system computers and software would be $66.9

[1]The Army Materiel System Analysis Activity performs independent evaluations of major system development efforts for the Army Materiel Command.

million (or 33 percent) less than the estimated CHS acquisition of computers and software for the maneuver control system ($134.4 million for a separate tailored acquisition for the interim maneuver control system versus an estimated $201.3 million for CHS).[2] This Army analysis raises serious questions about the claimed economic advantages of the consolidated CHS acquisition over separate tailored acquisitions.

Independent Assessments Found That CHS Strategy Has High Risk

The Army Materiel Systems Analysis Activity's independent assessment of the CHS initiative concluded that the CHS acquisition strategy has a high degree of risk. The primary factors leading to this conclusion were the absence of off-the-shelf products that meet CHS specifications, the lack of a pre-award test that represents the required processing for all battlefield systems, and the absence of a firm acquisition strategy with cost justification. In reacting to this conclusion, the ACCS program manager found the assessment to be factual and accurate, but disagreed that the CHS strategy has high risk. In his opinion, the overall risk is moderate.

Communication software required for Army tactical communication systems is an area of high technical risk for the CHS acquisition. The deputy ACCS program manager stated that communication interfacing—linking computers to Army tactical communication systems—as difficult and the program's greatest risk. ACCS officials told us they expect to use modern programmable communication devices that are becoming available from a variety of vendors to provide this capability.

However, software designed to work with Army tactical communication systems must be developed. Because offerors are not expected to have all communications software for the pre-award demonstration, the successful offeror will be allowed up to 10 months after contract award to complete the communications software.

The deputy program executive officer for command and control systems agreed there are some risks associated with developing communication interface software, but overall he did not believe the risk is high. To obtain an outside perspective, we asked an independent consultant to assess the technical risks associated with the CHS acquisition. He found that communications interface software was an area of high risk. We

[2]The Army has delayed the planned deployment of the CHS replacement for the interim maneuver control system from fiscal year 1990 to fiscal year 1993.

asked this established authority on Army tactical communication systems to review the CHS requ - t for proposal and related test and evaluation documents. His analysis concluded that a combination of undeveloped technologies, inadequate industry skill base, and undefined, or indefinite, CHS requirements creates a high risk that contractor efforts to develop interfaces from CHS to Army tactical communication systems will not be successful.

The Army has experienced development problems in past attempts to interface computers and battlefield communications systems. Some of the attempts, such as the communication control system, have failed, causing both controversy and delays in battlefield systems. The recently deployed maneuver control system (one of the battlefield control systems) was still experiencing data communications development problems after 7 years in development. In April 1987, the Army's Operational Test and Evaluation Agency reported that its independent assessment of the maneuver control system found, among other problems, the system failed to successfully demonstrate required Army tactical communications capabilities. Also, the fire support command and control system's prime contractor attributes some of that program's delays to communication software development difficulties. ACCS officials could not cite any examples of command and control system development programs that did not experience communication interface problems.

Required Testing of CHS Is Deferred

The Army plans to have the offerors demonstrate the ability of proposed products to meet many technical specifications of the request for proposal, but does not plan definitive tests of proposed CHS' ability to meet battlefield system requirements before awarding the CHS contract. The Army does intend to test the ability of CHS to support its battlefield systems, but only after production commitments are made. Even though Army regulations require a complete system to be successfully tested before making a production commitment, according to Army plans, $253 million will be spent for CHS before the Army determines whether CHS will satisfy battlefield system requirements.

Proposed CHS Not Fully Tested Prior to Contract Award

The Army plans to do limited testing of vendors' proposed CHS products before making a contract award. This pre-award testing is intended to verify offeror statements about basic hardware and software capabilities, but will not determine whether proposed CHS satisfies all request for proposal specifications or battlefield system requirements. For example, pre-award testing will not evaluate whether proposed CHS can operate with all required Army tactical communication systems or effectively execute battlefield system software that perform functions such as maintaining the status of friendly and enemy troop movements, fire support calculations, and aircraft tracking.

The deputy ACCS program manager said that the Army does not plan to conduct a more comprehensive pre-award test because it has decided that battlefield system developers can find ways to meet requirements with the computer hardware and software products specified in the CHS request for proposal. Further, he believed that a more comprehensive pre-award test should not be performed because: (1) the software for four of the five battlefield systems has not been developed; (2) the battlefield system software that has been developed cannot be used to test CHS without significant changes, and its use could give a competitive advantage to the contractors who developed the software; and (3) the test would take time to develop, delay the CHS acquisition, and increase the cost for offerors to bid.

The Army Materiel Systems Analysis Activity's independent assessment of the CHS initiative noted that comparing only the basic capabilities of computer hardware and software products could lead to not selecting the best CHS for battlefield systems. The report implies that the Army needs to develop a pre-award test that will determine the ability of proposed CHS to operate with all required Army tactical communication systems and meet the computing requirements of all battlefield systems

that will use CHS. Normally, such pre-award testing is used to establish whether proposed products meet requirements and to determine which proposal best meets user needs. Department of Defense and other federal procurement guidance calls for determining the ability of proposed products to meet the requirements of the systems designated to use them before awarding a contract.

Further, the Army's acquisition strategy assumes that products are already fully developed or require only minor changes to meet requirements. If this is correct, offerors should be able to provide products for pre-award testing that meet requirements without a lengthy period for development. If, on the other hand, a significant development effort is needed to meet requirements—for example, the development of communication software to operate with Army tactical communication systems, or the development of operating system features required for time-critical battlefield system operations—the Army would be risking unnecessary acquisition costs and delays if it awarded a production contract before the offeror demonstrated that proposed products meet requirements. If CHS proves to be unacceptable after contract award, the Army would have to either direct the successful offeror to modify the CHS selected, or initiate a new procurement for computer systems that provide the needed capabilities. Either situation exposes the Army to the risks of increased acquisition costs and delays in the availability of suitable computers and software for battlefield systems. As discussed in chapter 4, time is available to conduct system testing that would reduce the risk without delaying the deployment of the battlefield systems.

CHS Production Commitments Will Be Made Before Required Operational Testing Is Performed

Applicable Department of Defense Directives and Army regulations[1] require for major systems acquisitions that a complete prototype system, including software, be built to production specifications and successfully tested in a military environment before the Army makes a production commitment. These regulations require that off-the-shelf computer hardware and software be tested and evaluated, unless previous testing and other data provide sufficient evidence of acceptability. These requirements are intended to reduce the technical and operational risk of buying products that will not meet minimum Army requirements.

[1]See Defense Acquisition Circular 76-43, Department of Defense Directive 5000.3, and Army Regulation 70-1.

The House Committee on Appropriations recently expressed concern that off-the-shelf acquisitions too often do not include needed developmental and operational testing. Similar concerns were also expressed in a May 1, 1987 letter to the Secretary of Defense by the Chairman of the House Defense Appropriations Subcommittee. This letter, the subject of which is the CHS acquisition, states, in part:

"A rigorous development and operational testing program is necessary for ACCS [CHS] prior to commitment. Maintaining two teams through the DT/OT [development testing/operational testing] phases may be desirable in order to maximize competition and assure optimum performance."

These concerns regarding testing resulted, at least in part, from problems the Army experienced with two systems for which adequate testing was not done before the Army made production commitments—the Sergeant York air defense gun system and the maneuver control system (one of the battlefield systems designated to use CHS). When tested, the Army found that the gun did not meet important performance specifications. As a result, the Secretary of Defense cancelled the program after 64 of 146 units called for under the first two options of the contract were delivered. The target price for the two options was $788.6 million. In commenting on Sergeant York, the Department of Defense agreed that adequate and realistic operational performance testing could have prevented such unnecessary expenditures.

The maneuver control system program also experienced problems in meeting user requirements. The Army spent $26 million to buy a tactical computer system, a critical element of the maneuver control system, before operationally testing it. When operational testing was performed, the tactical computer system did not meet user requirements and was not used.

The Army's first planned operational test which would result in meaningful data on whether the CHS could be deployed was originally scheduled for late 1989. This schedule was contingent on each of the battlefield systems being ready at that time to test CHS. However, because of program delays and interim acquisitions, the testing of CHS with all battlefield systems will not be scheduled, according to Army plans, until at least 1991. This is well after the Army plans to commit to acquire fiscal year 1988 and 1989 production quantities of CHS (see table 1.2), estimated to cost at least $253 million.

Battlefield Systems Are Not Ready for CHS

The Army plans to buy production quantities of CHS before the battlefield systems have been developed and tested and are ready for deployment. The battlefield systems that are currently proposed to be supported by CHS are experiencing problems in their design and development activities. These systems are not currently scheduled to complete operational testing until at least 1991, with deployment scheduled a year later. Other battlefield systems will not require CHS for deployment until at least 1993. While acquiring limited quantities of CHS for system development and various testing may be warranted after appropriate contract award activities are completed, the planned acquisition of production quantities of CHS for deployment of battlefield systems is premature.

CHS-Supported Battlefield Systems Are Experiencing Delays

The Army plans for CHS to initially support the fire support and air defense battlefield systems. In 1988, the Army plans to acquire CHS estimated to cost $10.2 million to support development and testing for these systems. The Army also plans to spend $233 million between 1988 and 1991 to acquire CHS to deploy these systems. However, due to battlefield system software development problems, the Army now plans to deploy the fire support system in 1992, instead of the initially planned 1990 deployment date. Fire support program officials acknowledge these development and deployment delays.

The air defense system is facing at least a 6-month delay in software development. Originally, the Army planned to deploy this system starting in late 1991, but now projects early 1992. However, we believe these revised deployment schedules should be considered optimistic because (1) the contractor has projected additional software development delays and (2) the Army has a history of command and control system development efforts not meeting schedules.

As we reported in December 1987[1], following operational testing, the earliest that deployment for the CHS-supported battlefield systems can take place is 1992. Further delays are possible because deployment schedules for both systems assume that system development phases will overlap. Congress has expressed concern about proceeding with another development phase before the current phase has been successfully completed. The fire support program has received specific congressional

[1] Battlefield Automation: Status of Army Command and Control Systems Acquisition Cost and Schedule Changes (GAO/NSIAD-88- 42FS, December 9, 1987).

direction to successfully complete the current system development phase before starting the next phase.

Deployment of Other Battlefield Systems Is Years Away

The combat service support control system program has neither an approved required operational capability statement nor sufficient funding for a CHS procurement. No CHS acquisitions are planned for this system until after at least fiscal year 1992.

The maneuver control system is an older program that could begin using CHS equipment as soon as it is available and operationally tested. However, the Army decided to proceed with an interim acquisition and not to begin the major deployment phase of CHS for this system until 1993. The ACCS program plans call for the initial acquisition of CHS for this system in 1990, with most acquisitions occurring after fiscal year 1992. In fiscal year 1990, the Army plans to acquire CHS estimated to cost $31.1 million to develop, test, and make a partial deployment for the maneuver control system. No estimate has been made as to how much CHS would be needed if the acquisition were limited to the support of system development and testing.

Conclusions and Recommendations

Conclusions

The Army has not adequately demonstrated that the CHS acquisition strategy it is following is the best approach for acquiring computer hardware and software for battlefield systems. The CHS acquisition strategy is based on assumptions that off-the-shelf products with required capabilities would be readily available and that a combined acquisition would be economical. However, these assumptions are questionable because of Army market surveys and six vendors' opinions indicating that off-the-shelf products meeting all of the Army's requirements are not available, and an Army study which showed that a separate computer system acquisition would cost less than CHS for the maneuver control system. Further, an independent Army assessment of the CHS strategy concluded it has a high risk of being uneconomical and acquiring products that will not meet Army needs.

An analysis that compares the cost, operational effectiveness, and technical risk of alternatives for the acquisition and support of computer hardware and software is needed to determine the best approach for meeting mission needs before the Army awards a contract for CHS. The analysis should include an evaluation of the use of existing products versus developing new products, and separate tailored acquisitions for each battlefield system versus a combined acquisition.

The CHS request for proposal allows offerors to propose new or modified products that are unproven and to delay the demonstration of some required communication, processing, and environmental capabilities until after the contract is awarded. However, deferring the testing of required communication, processing, and environmental capabilities until after contract award places the Army at risk of incurring additional costs and delays if acceptable products are not delivered.

An independent Army assessment found that the CHS initiative has high risk in part due to the absence of a pre-award test to determine the ability of proposed CHS to meet battlefield system requirements. Requiring that proposed CHS successfully complete an Army-developed pre-award test that determines the ability of proposed computer hardware and software to meet battlefield system processing requirements and to operate with all required Army tactical communication systems would mitigate the Army's risk. Finally, the schedules of the individual battlefield systems intended to use the new computer systems have fallen behind, giving the Army additional time to analyze its acquisition strategy and test computer systems without delaying the deployment of battlefield systems.

If the Army were to demonstrate that a consolidated acquisition of CIIS for battlefield systems is justified, production commitments would be premature until successful operational testing had been completed. Consequently, we believe that after completing appropriate contract award activities (e.g., studies and pre-award tests), the Army should only acquire the limited quantities of CIIS needed for battlefield system development and operational testing, i.e., less than the 4,259 systems currently planned as the initial acquisition commitment. Further, we believe that the Army need not commit to acquiring deployment quantities of CIIS until the selected products have successfully completed operational testing and evaluation with the battlefield systems.

Recommendations

GAO recommends that the Secretary of the Army:

- Complete a full cost and operational effectiveness analysis demonstrating the best strategy for meeting battlefield system requirements before awarding a contract for CIIS;
- If the cost and operational effectiveness analysis shows that the common acquisition approach is the best strategy, conduct pre-award testing that determines the ability of each vendor's CIIS to meet critical processing and communication requirements of the four battlefield systems; and
- If, as a result of successful pre-award testing the Army proceeds with the acquisition, initially procure only those quantities needed for development and testing and defer production quantity commitments for deployment until operational testing shows that the CIIS enables the battlefield systems to meet their required operational capabilities.

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Other GAO Reports on ACCS CHS Related Programs

Evaluation of Army's Mobile Subscriber Equipment Program (GAO/NSIAD-85-117, July 16, 1985)

Fire Support System: Army's Plans to Improve Its Fire Support Capabilities (GAO/NSIAD-86-115BR, May 5, 1986)

Tactical Intelligence: DOD's Joint Tactical Fusion Program (GAO/C-NSIAD-86-27, July 31, 1986)

Fire Support System: Status of Fire Support System's Development (GAO/NSIAD-86-212FS, September 15, 1986)

Fire Support System: Army's Plans to Improve Its Fire Support Capabilities (GAO/NSIAD-86-116BR, September 19, 1986)

Defense Acquisition Programs: Status of Selected Systems, Appendix II, pp. 35-39, "All Source Analysis System" (GAO/NSIAD-87-128, April 2, 1987)

Battlefield Automation: Army's Efforts to Automate Combat Service Support (GAO/NSIAD-87-178FS, July 31, 1987)

Battlefield Automation: Field Artillery Data Systems Acquisition Problems and Budget Impacts (GAO/NSIAD-87-198BR, July 31, 1987)

Battlefield Automation: Army Air Defense Command and Control System Acquisition and Budget Issues (GAO/NSIAD-87-208BR, September 28, 1987)

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